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AUTHOR Birdsall, Stephen S.; Gunville, J. Michael
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ABSTRACT

This paper discusses a study to determine patterns of residential segregation by sex in Washington, D.C. over a 30 year period. Objectives were to explain statistically sex ratio distribution in housing, identify unsuspected sex discrimination processes affecting urban populations, and to clarify residential clustering. Washington, D.C. was selected for study because it has been exceptionally female dominant since 1940. Data were obtained from earlier studies of housing patterns and from census figures. The method was to analyze statistically all census tracts within the central city in 1970 and to compare results with data from earlier studies of housing patterns since 1940. Variables tested in addition to sex-specific factors included racial composition of city tracts, local economic or institutional factors such as military installations, age structure, and median per capita income of tract residents. Findings indicated that females were numerically dominant in a zone of contiguous tracts within the central city; this dominance persisted for all census years studied; male dominant tracts were widely scattered in contrast to the clustered female dominant tracts; female dominant tracts were characterized by greater proportions of their population over 60 years of age and more owner-occupied housing; and segregation by sex is less than, and seemingly unrelated to, segregation by income, race, or ethnic group. The conclusion is that female dominant census tract populations in Washington, D.C. persist because of sex-specific factors including the desire to live in well-settled areas with high percentages of owner-occupied housing and to settle in areas where there are large numbers of other women. (DB)

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SEGREGATION BY SEX: CHANGING PATTERNS IN WASHINGTON, D.C., 1940-1970

by
Stephen S. Birdsall and J. Michael Gunville

The purpose of this study was to identify, if present, patterns of persistent segregation by sex within an urban area and to test the validity of explanations of racial segregation for such patterns insofar as possible with census tract data. It was hoped that through such a study, we could 1) identify the existence of unsuspected processes affecting urban populations, at least indirectly, 2) clarify the relationship between the heads of household's sex and other factors that affect residential clustering, and 3) initiate the accumulation of information that would eventually permit more rational anticipation of sex-specific public service needs.

It may be necessary at the outset to reiterate the difference between segregation and discrimination. In common usage, the two terms are synonymous. As pointed out by Becker and by Muth, this is incorrect (1). Individuals or activities are segregated when they are spatially clustered by type. Individuals are subjected to discrimination, on the other hand, when their personal resources (e.g., income, energy, creativity, labor) are undervalued relative to those of other members of society. Thus, segregation can exist without discrimination; discrimination can exist without a resultant segregation of those discriminated against. The concern in this paper is with segregation (2).

INTRODUCTION. The possibility of intraurban segregation by sex has not been much studied. Schnore refers to ". . . the three principles of segregation according to which American urbanites have long been 'sifted and sorted' in space . . . [as] color or ethnicity, social class, and type of family" (3). These three factors have been identified through the factor-ecological

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methods employed in social area analysis (4). Variables dealing with sex balance in these analyses tend to fall in the family status factor, but any specific relation between these variables and residential location is lost because of the combinatorial techniques used. We suggest that segregation on a sexual basis is distinct from the general "family status" framework and is, in fact, closer to the patterns associated with ethnicity and socio-economic status. It should not be taken from this that ethnicity and socio-economic status are fully, or even largely interdependent in their effects on residential segregation. On the contrary, it has become apparent from previous research that residential exclusions and self-selections are made on the basis of race independent of socio-economic considerations (5). Residential clustering on the basis of sex has not been studied to the same extent.

While the importance of sex in residential segregation has received little attention, the numerical sex balance of a population was treated until recently as though its primary significance was causative, sociological, and largely aspatial. Studies dealt with what was viewed as the essentially violent nature of males, the greater importance of religion to women, and occupational patterns identifying "women's work" (6). Speculation about the social repercussions of numerical sex imbalance for unmarried adults also appeared in the literature. One author, for example, worried about women "doomed to spinsterhood" or "forced to continue through life without husbands" because of the shortage of men in the U.S. population (7). Although the sexist innuendo in such perspectives is less likely to appear today, the aspatial view of sex disproportions in populations has been more persistent.

In this paper, we examine numerical sex imbalance in a spatial context and the patterns of this imbalance as a consequence of social forces rather than as a cause of such forces. Are there significant indications of urban residential segregation by sex? How have the patterns of numerical imbalance between the sexes changed over time? To what degree can these patterns be explained by variables drawn by analogy from studies of segregation by race? It is our purpose in this paper to answer each question in turn: identify a pattern of segregation by sex, examine its persistence within a single city, and analyze the spatial distribution of sex imbalance.

The measure used to indicate the degree of numerical sex imbalance is the sex ratio. Calculated as the number of males in the population per 100 females, a ratio of 100 indicates numerical balance, values greater than 100 indicate a surplus of males, and values lower than 100 show a female surplus. The greater the ratio's distance from 100, the greater is the numerical inequality of the sexes in that area's population. Data were used in this study at the census tract level.

Washington, D.C. was selected for study using the period from 1940 to 1970. Washington has been exceptionally female dominant even though large cities consistently possess sex ratios slightly below 100 (8). The tens of thousands of women employed by the Federal government during World War II led some to call the city "Girl's Town" (9). From a city-wide sex ratio of 92 in 1940, a steady decline during the subsequent three decades brought the ratio to just less than 87 by 1970. We believed that our conclusions regarding segregation by sex would be stronger when drawn from a city with a history of sex imbalance. If female surplus within the city, for example, is localized in spite of an overall numerical dominance,

the significance of that localization is likely to be greater. Washington also contains a sufficient number of tracts to identify distinctive patterns. Even though it may be unfortunately artificial to restrict the analysis to the central city rather than extend it to Washington's metropolitan limits, problems of data unit comparability inherent in a longitudinal study such as ours would invalidate conclusions pertaining to the larger area.

PATTERNS OF DOMINANCE. It was assumed that if each sex is affected by locational factors in an even or in a highly complex manner, the spatial distribution of males and females in a population would be approximately even, or it would be segregated but uneven in what appeared to be a random pattern. On the other hand, if there appeared to be a non-random segregated pattern of numerical dominance by either sex, it would be suggestive of equivalently non-random effects in the population's residential selection process.

The distribution of female numerical superiority within the city has been far from even (Figure 1). A cluster of 17 contiguous census tracts in the northwestern portion of the city possessed sex ratios in 1940 reflecting fewer than four males for every five females in the tract population. The contiguity of these tracts suggests that a non-random residential selection process had affected females differently from males prior to 1940.

The distributions of sex ratios for subsequent census years reflect the city's continued segregation by sex and support the suggestion of a non-random residential selection process at least for females. By 1950, Washington's population had become sufficiently female that about

two-thirds of the area was occupied by female dominant tracts. The 1940 cluster of tracts with very low sex ratios persisted with an increase in size through the addition of several adjacent tracts and a slight locational shift toward the edge of the political city. These patterns were repeated in 1960 and 1970. By 1970, 84 percent of all District of Columbia tracts were moderately to strongly female with sex ratios of 95 or lower. Most of the 27 tracts occupied by populations with sex ratios below 80 were located in the large, well-established cluster in the city's northwestern corner.

The distribution of tracts with a male dominant population has also been persistent although very different in form than that for females (Figure 2). Tracts with sex ratios above 105, indicative of moderate to heavy male dominance were dispersed in 1940 and remained dispersed through subsequent census years. Detailed changes did occur in the pattern, but most alterations appear to be a function of changes in census tract size and shape. In general, the scattered locations of tracts with high sex ratios can be explained by local institutional factors. Male dominant tracts have been those containing large hospitals, military installations, and the hotels and offices grouped around the original Federal complex. By 1970, less than 11 percent of the District's tracts possessed populations with sex ratios in excess of 105.

Throughout the 1940-1970 study period, the city's population has arranged itself, or been arranged by external conditions, into a pattern of clear segregation by sex. This segregation is not as great as that typically associated with racial and ethnic groups (10). Undoubtedly, married couples and their children usually comprise a sufficiently large

proportion of tract populations to reduce the appearance of extreme numerical sex imbalance. Nevertheless, extreme imbalances do appear. The tract with the lowest sex ratio in 1970 contained a total population of more than 9000 with a ratio of only 50 males for every 100 females.

COMPONENTS OF THE SEGREGATION. Several processes that may have affected the appearance of differential residential selection by sex among Washington, D.C.'s population have been operating since 1940. The racial composition of the city changed dramatically from 29 percent black in 1940 to almost 72 percent in 1970. Sections of the city with predominantly black populations have consistently possessed higher average sex ratios than the white portions of the city. The predominantly black tracts have not been dominantly male, however, they have only been less dominantly female than the white tracts. This suggests that whatever has affected the residential choice opportunities in the city for women may have been more strongly felt within the white population. And because young black males are admittedly undercounted in the census, these ratio differences by race are probably even greater than they appear to be here.

In addition to its racial composition and local economic or institutional factors, a population's sex ratio can be affected by its age structure. Survival rates by sex for birth cohorts are approximately equal following the first year of life until about age 55 or 60 at which time men begin to die at higher rates than women until over age 75. This means that as a population ages, or as a larger proportion of a population is comprised of the elderly, that population's sex ratio becomes smaller.

A graph of sex ratio changes by age cohort by census year in Washington, D.C. is instructive in this regard (Figure 3). As could be

expected, the sex ratio for the city's 0-5 year olds was about 100 at each census (the same number of males and females) and dropped to lower ratios for each older cohort, again for all census years. However, whereas the 15-20 and 20-25 year old groups contained the earliest downward shift in sex ratios each decade, the drop was much greater during 1960 and 1970. We suspect the growing importance of young black men "missed" in recent census counts. Further, these later years contained larger male proportions in the immediately following age groups. The equally sharp rise in the ratios for 25 to 40 year olds probably reflects the growth in the government following the Korean War.

Also indicated in the graph is the increasing proportion of the population older than 50 that was female at each successive census. In spite of the large male populations between 25 and 45 years old present at least since 1960, the sex ratio for 50-55 year olds has been lower each census year. When combined with the precipitous drop in the ratios beyond age 60, it is apparent that there has been an increasing population of single elderly women residing in the District.

In an attempt to clarify the bases for the patterns of residential segregation by sex, stepwise multivariate regression and correlation analyses were performed on 1970 tract data for Washington, D.C. Although it would have been desirable to conduct the analyses for the entire 1940-1970 study period, problems of data comparability and availability prevented this. Furthermore, while the aggregate data used prevents identification of behavioral motivation in residential selection by individuals, indications of locational association can be clarified between these important components of population structure. To avoid the complicating effects of

sex-specific institutions (colleges, rest homes, hospitals), tracts containing institutional populations that comprised a large proportion of the total tract population were removed prior to statistical analyses.

Independent variables were selected in light of previous studies of residential segregation, even though such research has been strongly oriented toward segregation by race or ethnic group. Marshall and Jiobu found that although attitudinal factors are important in determining segregation, ". . . access to housing in certain areas rests, to an important degree, upon the relative distribution of occupational status and purchasing power" (11). While the issue of status and sex is too difficult to disentangle here, median per capita income (INCOME) and mean rent per rented housing unit (MNRENT) were selected as surrogates for purchasing power (and possibly for occupational status). Patterns of residential selection are also affected by dependence on locationally restrictive rental housing and the higher residential turnover rate among renters (12). Percent of housing units occupied by renters (PERRNT) and the percent of housing units in which the head of household moved in within the last 10 years (PERMVD) were selected to represent these factors of residential transience. In addition, the relation between aging and numerical sex balance was recognized by inclusion of the percent of the tract population 60 years old or older (ELDRLY). It was found that the degree of explanation achieved through analysis of tract sex ratios with these variables was not increased by treating blacks and whites independently. Correlation coefficients were lower for each group when analyses were run separately for blacks and whites than when the city's population was considered as a whole.

The results of the analyses confirmed the importance of age and residential transience. The variables selected to represent purchasing power, on the other hand, were not statistically significant contributors, even at 0.10, to the explanation of the distribution of 1970 sex ratios. The most important variable was percent of population over 60 years of age (ELDRLY) with a simple Pearson's r of -0.24 indicating the expected decline in sex ratio with an increase in proportion of the elderly present in a tract. The second and third variables selected were the percent of housing units where the head of household moved within the last ten years (PERMVD) and the percent of housing units occupied by renters (PERRNT), with partial correlation coefficients of -0.28 and +0.16, respectively. These results indicate that after controlling for the effects of age, sex ratios will decrease among tracts with a more transient population, and after controlling for both age and housing turnover, sex ratios will decrease among tracts with a smaller proportion of the population in rental housing. In other words, there appear to be at least two component groups contributing to female numerical dominance in the District. The most important is composed of elderly, more settled populations in owner-occupied housing. The second group, for which the proportion elderly is not important, is more transient (or more recently arrived in Washington) but still residing in tracts containing relatively fewer renter-occupied units. The consequent regression equation, significant at 0.02, confirms the form of this interrelationship. With the tract sex ratio as dependent variable, the equation is

$$Y = 110.2 - 0.\,?\,(\text{ELDRLY}) - 0.35\,(\text{PERMVD}) + 0.12\,(\text{PERRNT}).$$

In spite of the level of significance achieved, the degree of explanation for the distribution of sex ratios was low ($R = 0.395$). A plot

of residuals from regression suggested an interior ring of more strongly male tracts peripheral to the Federal complex than could be expected from the age and residential transience variables (Figure 4). Because the effects of age, residential turnover, and rental occupancy have been taken into account and income and race were found to be unimportant, the pattern of residuals cannot be described in such terms as groups with larger than expected numbers of low income elderly males or high turnover male residents desiring proximity to the Federal complex. We believe that the absence of females in the predicted levels within this region may be a function of perceived security. This section of the city is older and more densely built-up than many others. It may be that, given the option, women will be less likely to live in this zone because they do not feel safe there. Although data are not easily available to test this supposition, the distinct band of interior tracts with underpredicted sex ratios is suggestive.

SUMMARY. In sum, analysis of sex ratio distributions in Washington, D.C. between 1940 and 1970 confirm the presence of a zone of distinctly contiguous tracts with female numerical dominance. Furthermore, the persistence of this zone across the four census years studied supports the argument that the city's population is "sorted and sifted" according to sex just as it is by the better recognized socioeconomic, life cycle, and ethnicity factors. Although indexes of dissimilarity indicate lower levels of segregation by sex than is typical for race, the contrast between scattered tracts of male dominance and the cluster of female dominant tracts suggests the operation of sex specific processes of residential selection. And finally, female dominant tracts are those with higher

proportions of their population over 60 years of age and moderately well-settled in owner-occupied housing, or those with more recent arrivals to their current residence but again with fewer renters among the households. Income and race do not contribute significantly to this explanation of sex ratio distributions.

FOOTNOTES

1. Gary S. Becker, The Economics of Discrimination (Chicago: University Of Chicago Press, 1957); Richard F. Muth, "Residential Segregation and Discrimination," in G. M. von Furstenberg, B. Harrison, and A. R. Horowitz (eds.), Patterns of Racial Discrimination, Volume 1: Housing (Lexington, Mass.: D.C. Heath and Company, 1974), pp. 107-19.
2. Although it is tempting to assume discrimination when segregation can be identified, we cannot do so on the basis of information gathered for this study; the tract level data scale is too coarse.
3. Leo F. Schnore, "Social Classes in Cities and Suburbs," in Amos H. Hawley and Vincent P. Rock (eds.), Segregation in Residential Areas (Washington, D.C.: National Academy of Sciences, 1973), p. 190.
4. E. Shevky and Wendell Bell, Social Area Analysis (Menlo Park, Calif.: Stanford University Press, 1955); Robert A. Murdie, "The Social Geography of the City: Theoretical and Empirical Background," in Larry S. Bourne, Internal Structure of the City (New York: Oxford University Press, 1971), pp. 279-90; Phillip H. Rees, "Concepts of Social Space: Toward an Urban Social Geography," in B.J.L. Berry and F.E. Horton, Geographic Perspectives on Urban Systems (Englewood Cliffs: Prentice-Hall, 1970), pp. 306-94.
5. J. R. Pinkerton, "City-suburban residential patterns by social class: A review of the literature," Urban Affairs Quarterly, Vol. 4 (June 1969), pp. 499-519.
6. For examples of each, see: L. Radzinowicz, "Variability of the Sex-Ratio of Criminality," Sociological Review, Vol. 29 (January 1937), pp. 76-102; L. Fry, The United States Looks at its Churches (New York:

Institute of Social and Religious Research, 1930); and C.G. Woodhouse; "Some Trends in Women's Work," Social Forces, Vol. 16 (1938), p. 546.

7. Joseph H. Greenberg, Numerical Sex Disproportion (Boulder, Colo.: University of Colorado Press, 1950), p.3.

8. Greenberg, op. cit., footnote 7.

9. Hans von Hentig, "The Sex Ratio," Social Forces, Vol. 30 (1952), pp. 443-49.

10. Dissimilarity indexes calculated using the Taeuber method, for example, were less than 10 for all census years studied while values above 85 are typical for racial segregation. For use of this index to measure levels of racial segregation, see K. Taeuber and A. F. Taeuber, Negroes in Cities (Chicago: Aldine, 1965).

11. Harvey Marshall and Robert Jiobu, "Residential Segregation in U.S. Cities: A Causal Analysis," Social Forces, Vol. 53, No. 3 (March 1975), p. 458.

12. See Donald L. Foley, "Institutional and Contextual Factors Affecting the Housing Choices of Minority Residents," in Hawley and Rock, op. cit., footnote 3, pp. 85-147; and R. McAllister, E. Kaiser, and E. Butler, "Residential Mobility of Blacks and Whites: A National Longitudinal Survey," American Journal of Sociology, Vol. 77 (1972), pp. 445-56.

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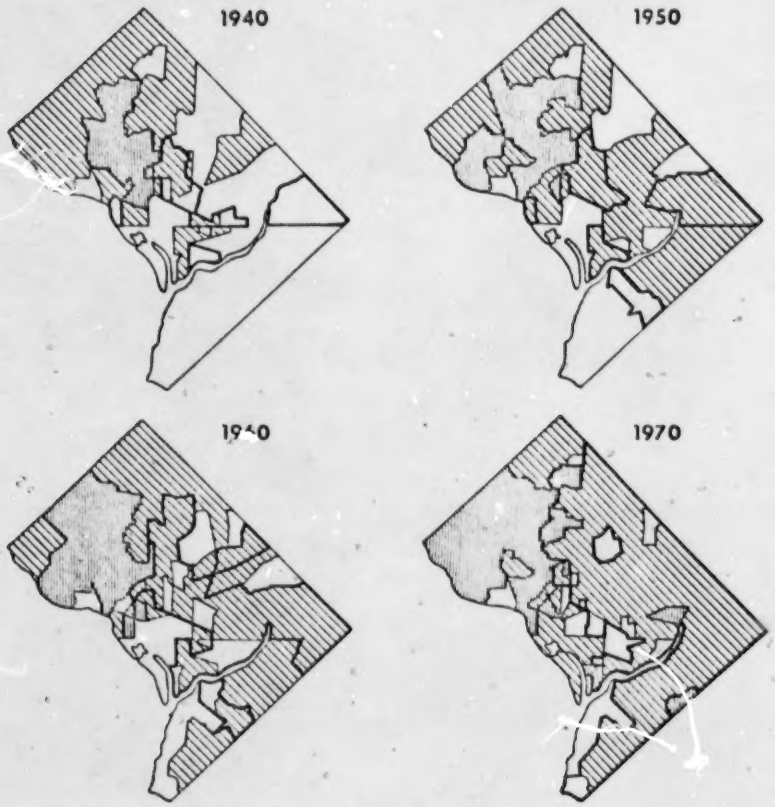
WASHINGTON, D.C.
FEMALE DOMINANT TRACTS



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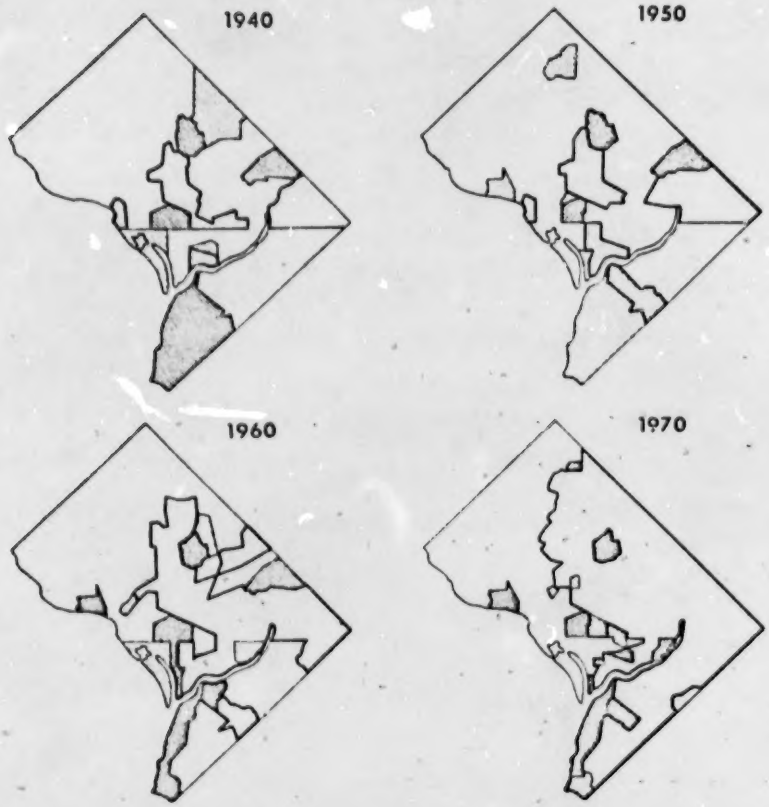
WASHINGTON, D.C.
MALE DOMINANT TRACTS



Dominance		Sex Ratios
Moderate		106 - 120 Males/100 Females
Heavy		121 or More Males/100 Females

(Dark lines enclose areas 60% or more non-white)

SEX RATIOS BY AGE COHORT
1940 - 1970

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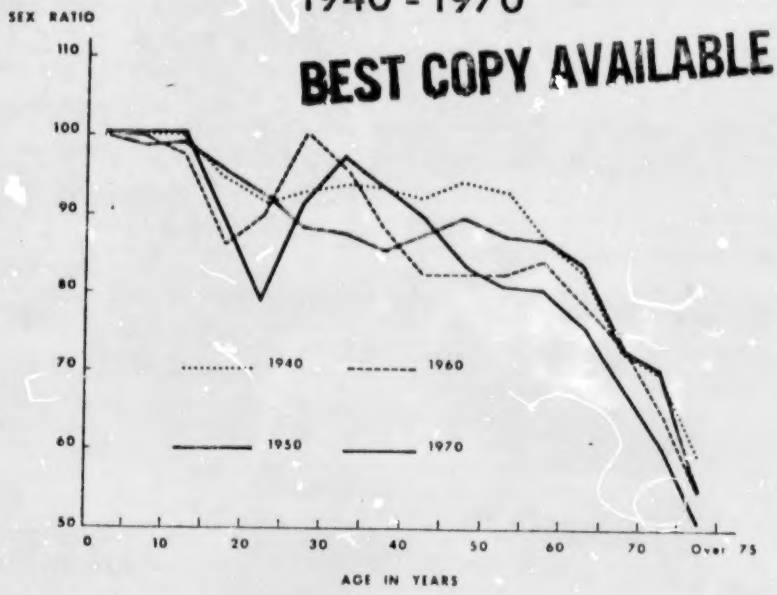

RESIDUALS FROM REGRESSION